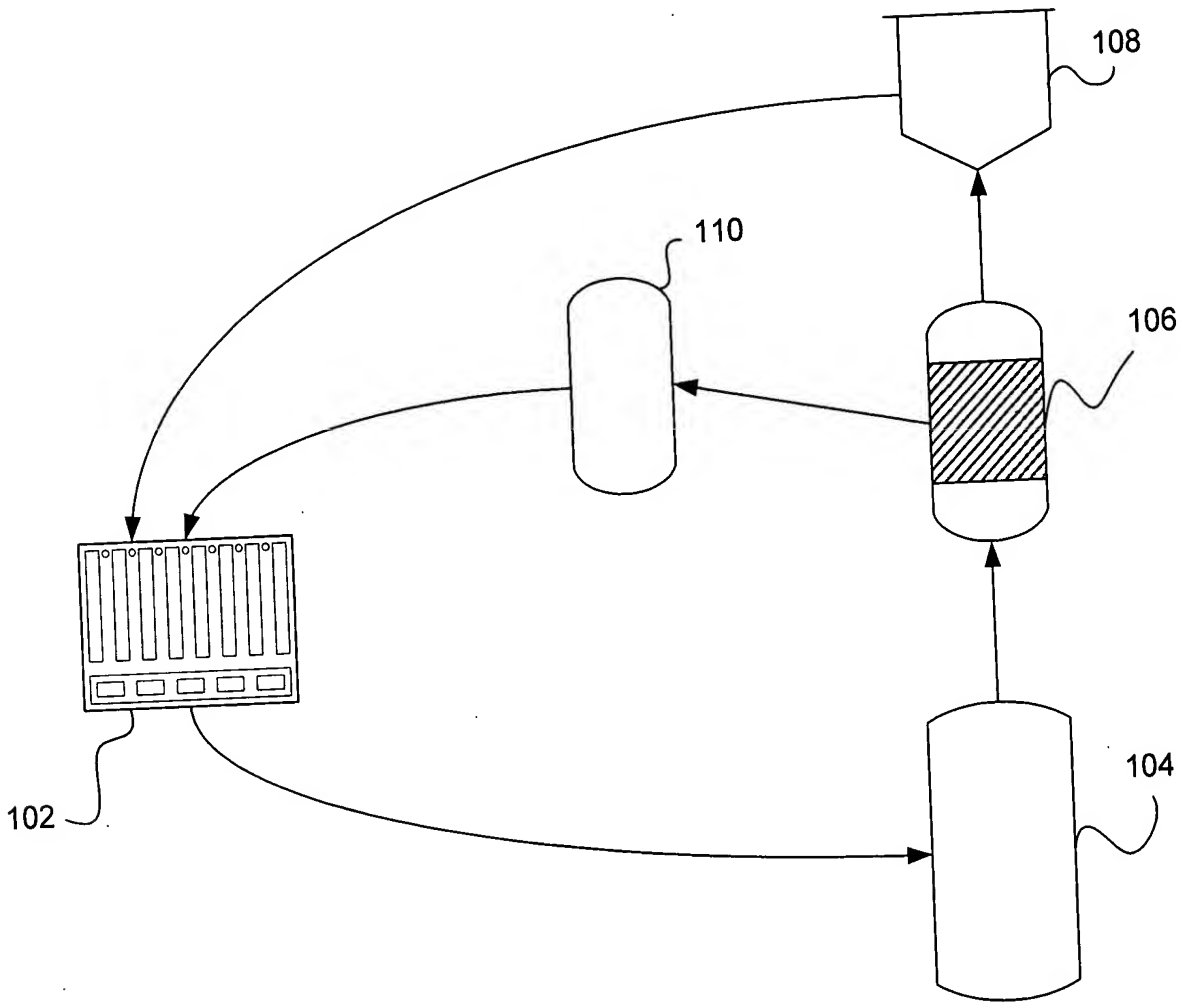

Figure 1

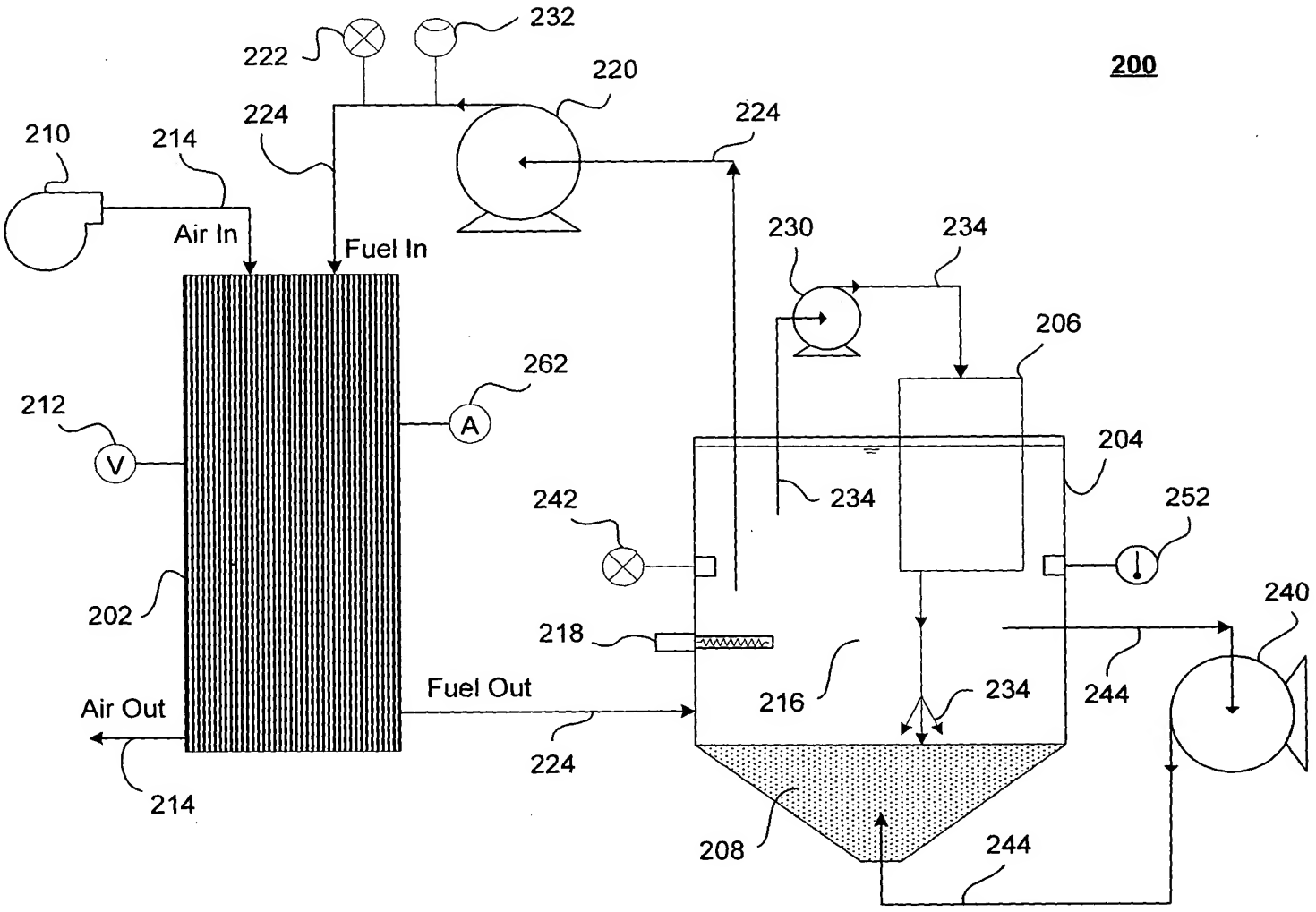
200
232
222
220
224
224
210
214
Air In
Fuel In
230
234
206
262
212
A
V
204
242
234
252
202
218
216
234
240
244
Fuel Out
Air Out
224
214
208
244

Figure 2

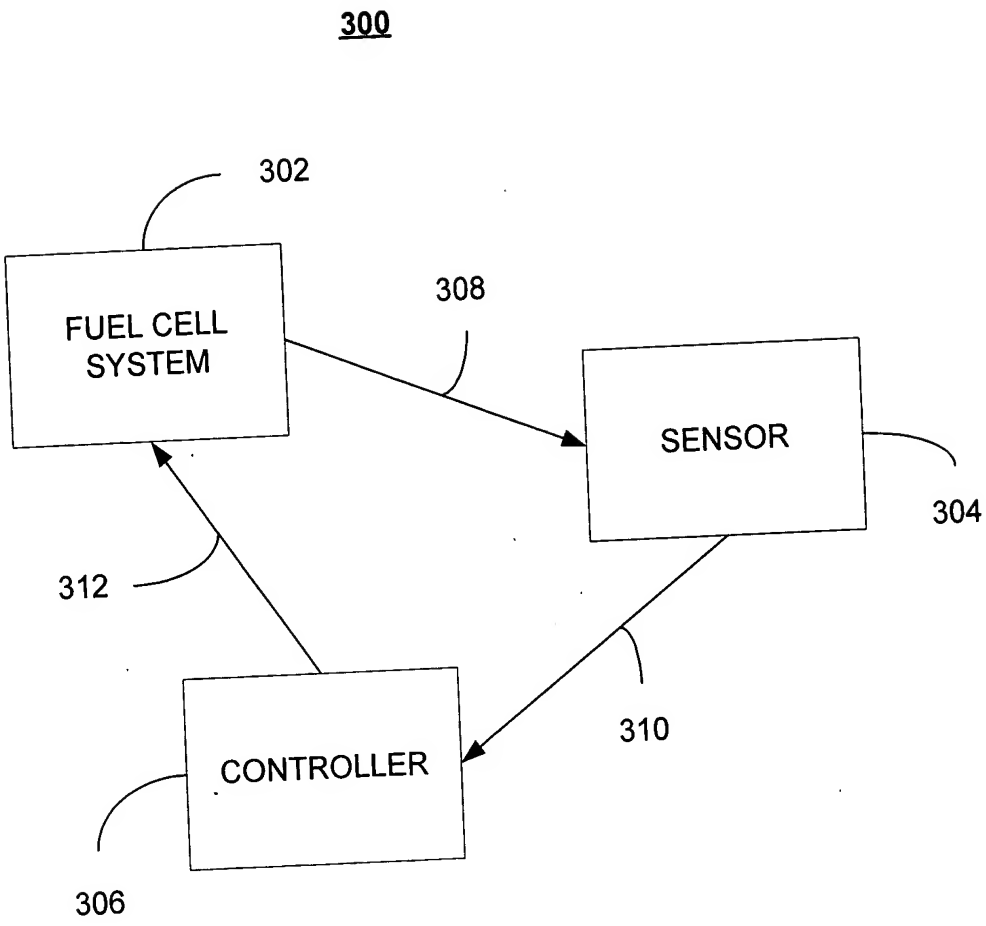
300
302
FUEL CELL SYSTEM
308
SENSOR
304
312
310
CONTROLLER
306

Figure 3

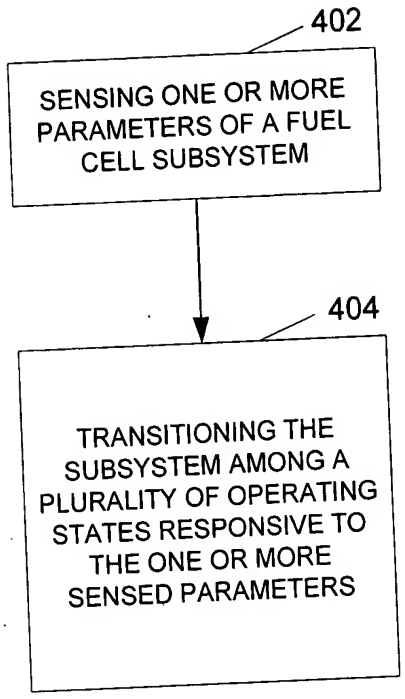

Figure 4a

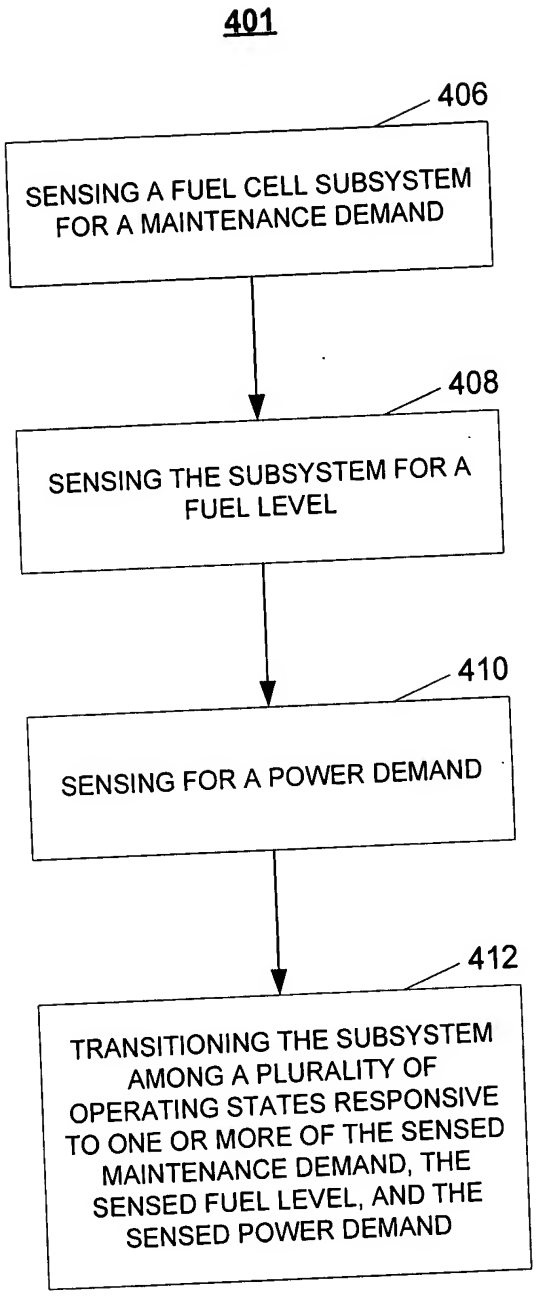

Figure 4b

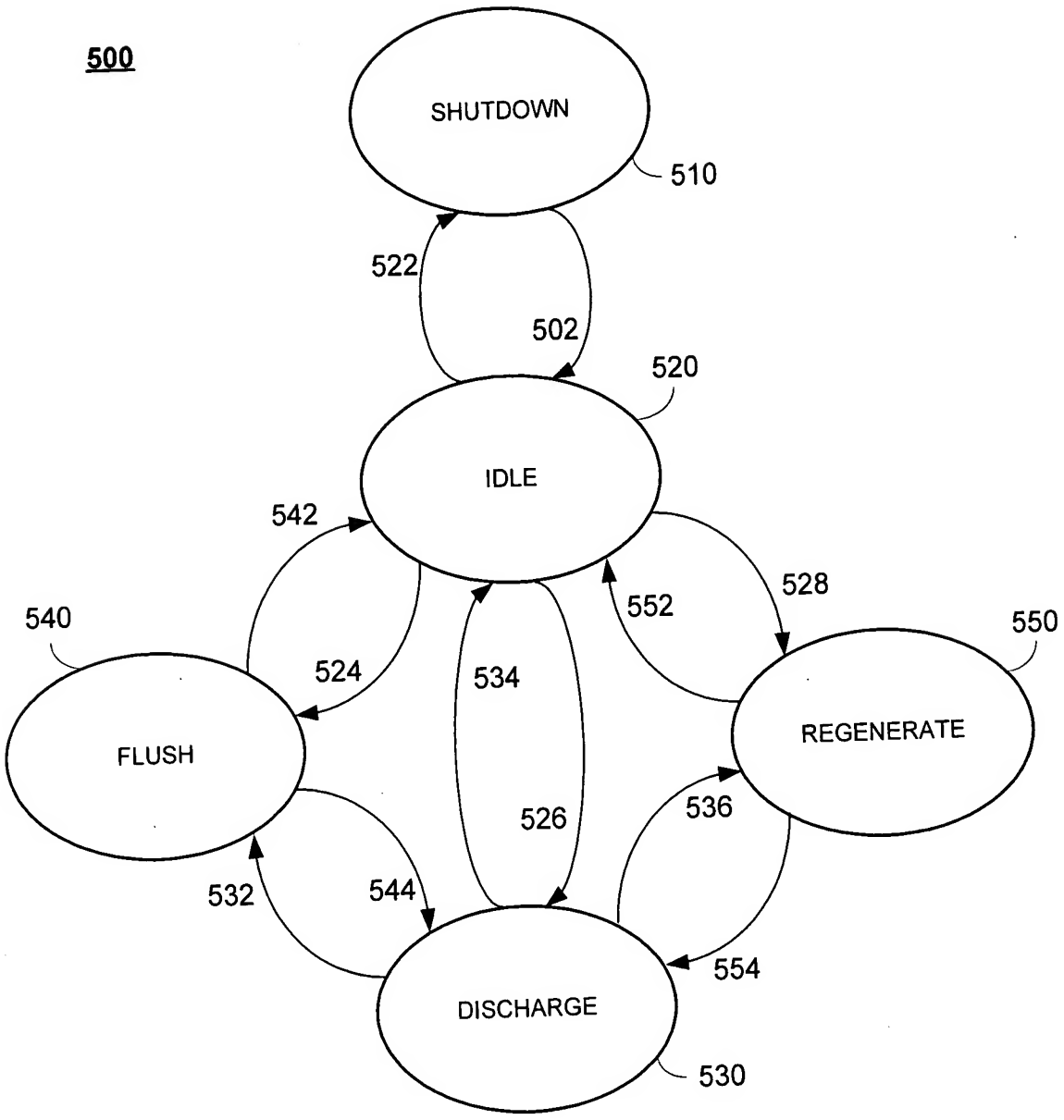
500
SHUTDOWN
510
522
502
520
IDLE
542
528
552
540
550
524
534
FLUSH
REGENERATE
536
526
532
544
554
DISCHARGE
530

Figure 5

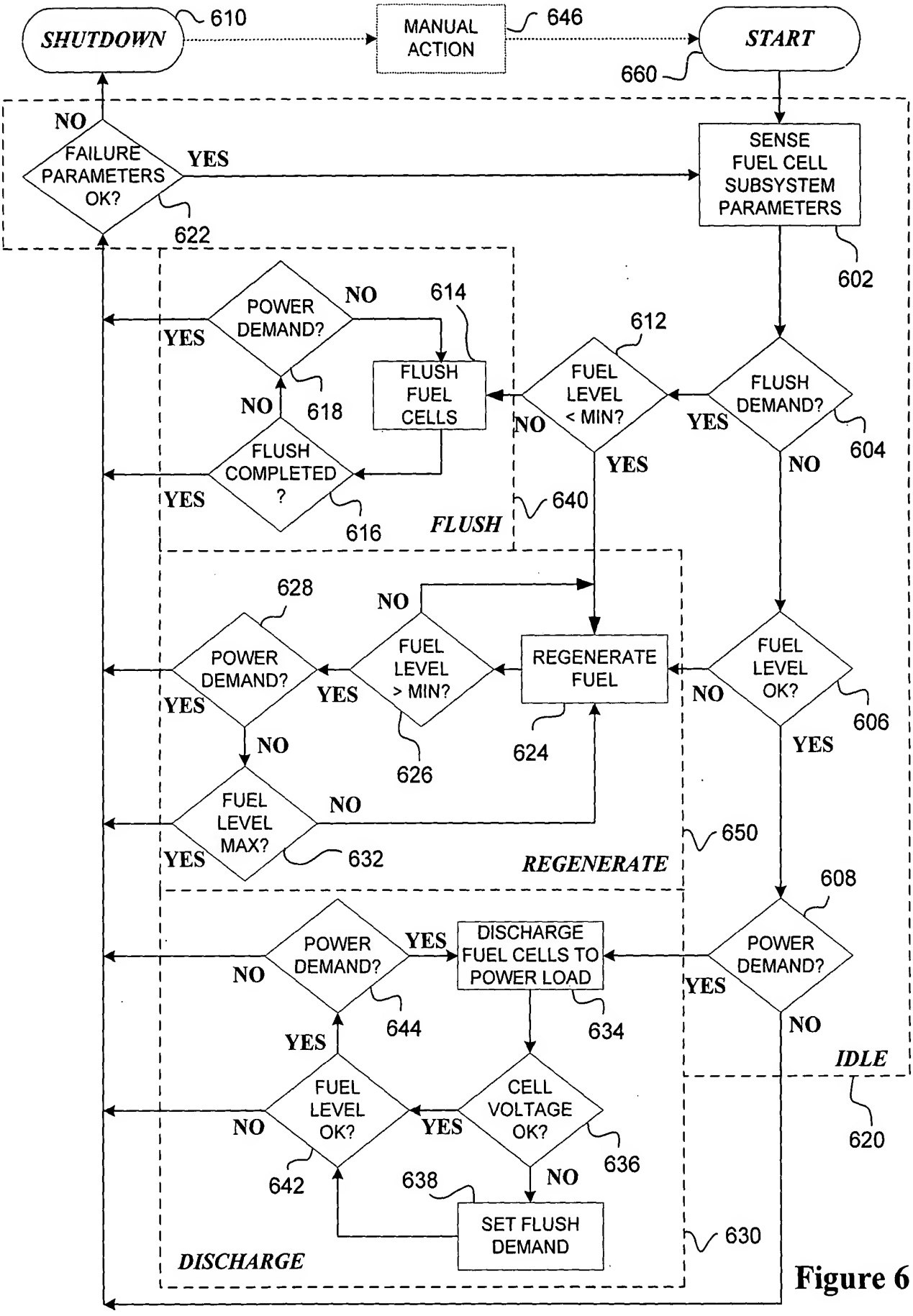
SHUTDOWN
610
MANUAL ACTION
646
START
660
NO
FAILURE PARAMETERS OK?
YES
622
SENSE FUEL CELL SUBSYSTEM PARAMETERS
602
POWER DEMAND?
NO
614
YES
NO
618
FLUSH FUEL CELLS
FUEL LEVEL < MIN?
612
NO
FLUSH DEMAND?
YES
604
FLUSH COMPLETED ?
YES
616
FLUSH
640
YES
NO
628
NO
POWER DEMAND?
FUEL LEVEL > MIN?
REGENERATE FUEL
FUEL LEVEL OK?
NO
606
YES
YES
NO
626
624
FUEL LEVEL MAX?
NO
YES
632
REGENERATE
650
608
POWER DEMAND?
YES
DISCHARGE FUEL CELLS TO POWER LOAD
POWER DEMAND?
YES
NO
644
634
NO
YES
IDLE
620
FUEL LEVEL OK?
CELL VOLTAGE OK?
NO
YES
636
642
638
NO
SET FLUSH DEMAND
630
DISCHARGE

Figure 6

700

FLUSH

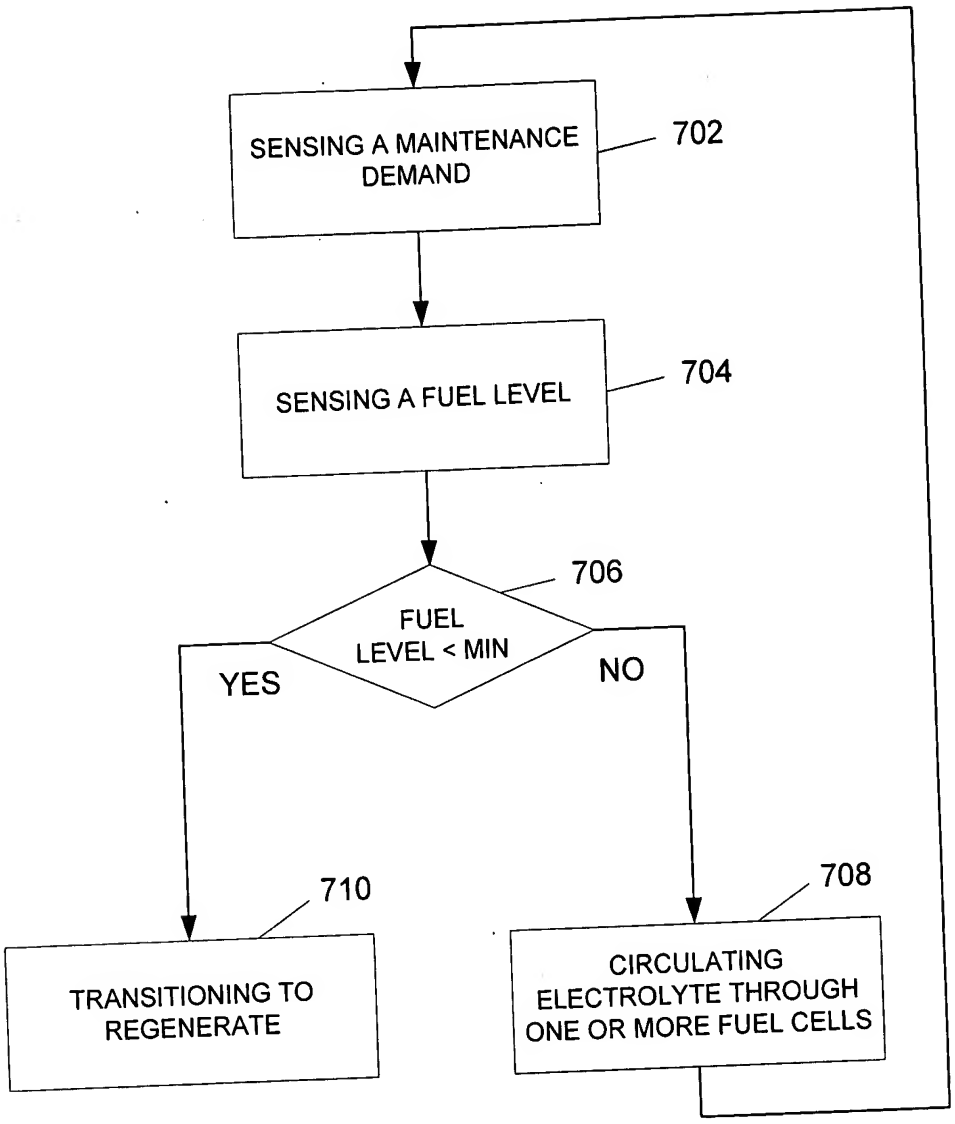

Figure 7

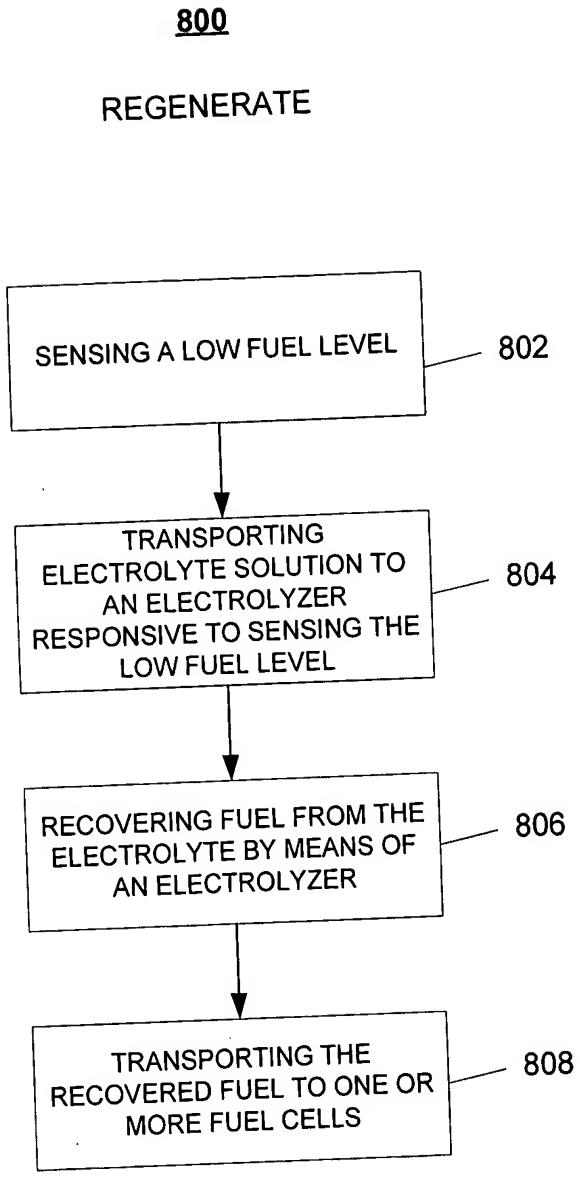
800
REGENERATE
SENSING A LOW FUEL LEVEL
802
TRANSPORTING ELECTROLYTE SOLUTION TO AN ELECTROLYZER RESPONSIVE TO SENSING THE LOW FUEL LEVEL
804
RECOVERING FUEL FROM THE ELECTROLYTE BY MEANS OF AN ELECTROLYZER
806
TRANSPORTING THE RECOVERED FUEL TO ONE OR MORE FUEL CELLS
808

Figure 8

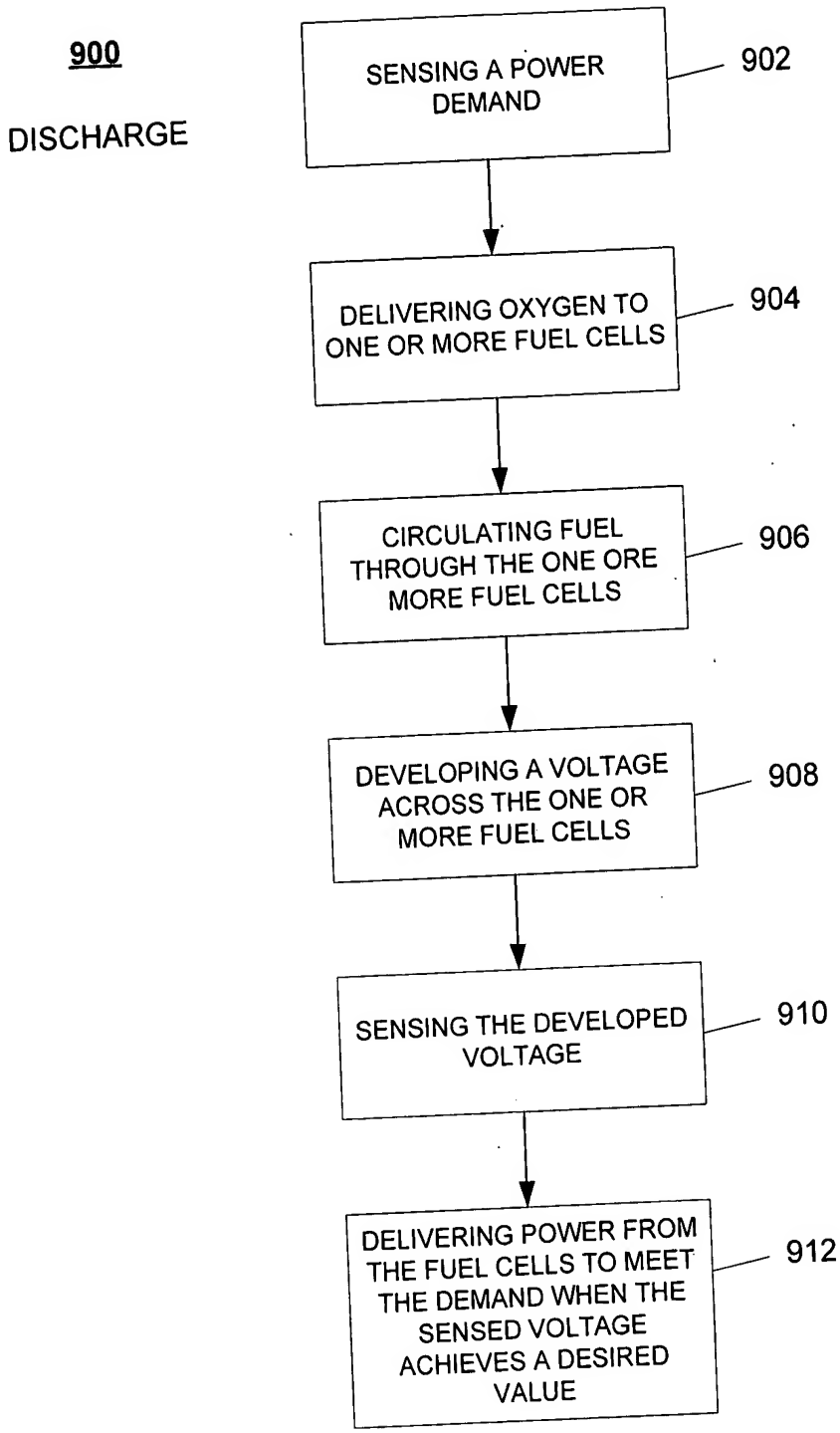
900
DISCHARGE
SENSING A POWER DEMAND
902
DELIVERING OXYGEN TO ONE OR MORE FUEL CELLS
904
CIRCULATING FUEL THROUGH THE ONE ORE MORE FUEL CELLS
906
DEVELOPING A VOLTAGE ACROSS THE ONE OR MORE FUEL CELLS
908
SENSING THE DEVELOPED VOLTAGE
910
DELIVERING POWER FROM THE FUEL CELLS TO MEET THE DEMAND WHEN THE SENSED VOLTAGE ACHIEVES A DESIRED VALUE
912

Figure 9

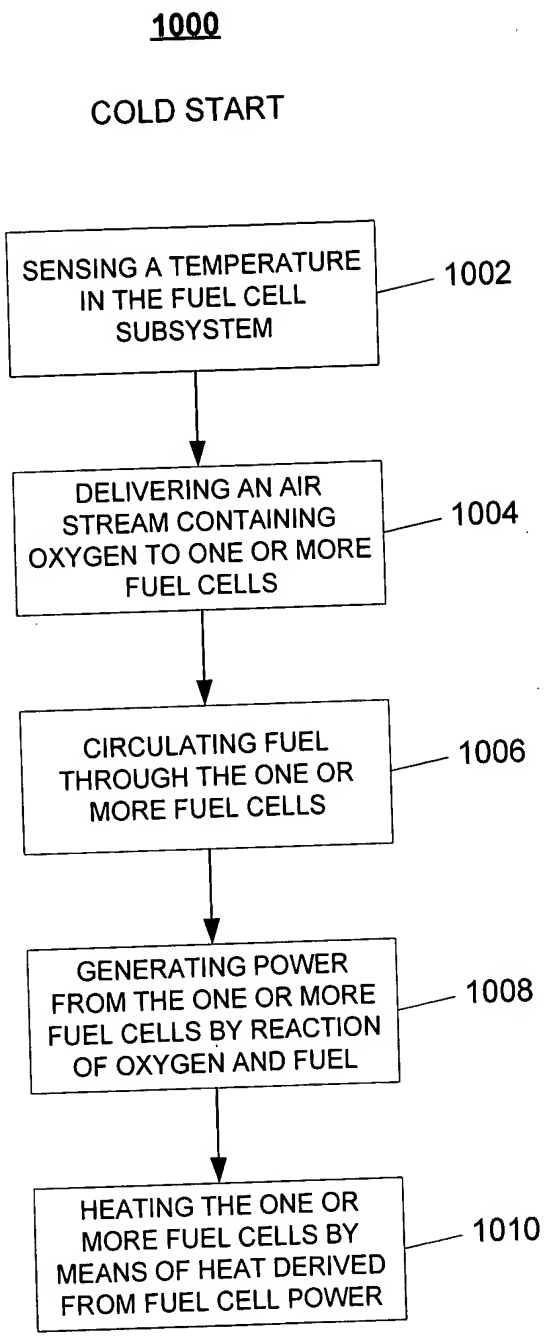
1000
COLD START
SENSING A TEMPERATURE IN THE FUEL CELL SUBSYSTEM
1002
DELIVERING AN AIR STREAM CONTAINING OXYGEN TO ONE OR MORE FUEL CELLS
1004
CIRCULATING FUEL THROUGH THE ONE OR MORE FUEL CELLS
1006
GENERATING POWER FROM THE ONE OR MORE FUEL CELLS BY REACTION OF OXYGEN AND FUEL
1008
HEATING THE ONE OR MORE FUEL CELLS BY MEANS OF HEAT DERIVED FROM FUEL CELL POWER
1010

Figure 10

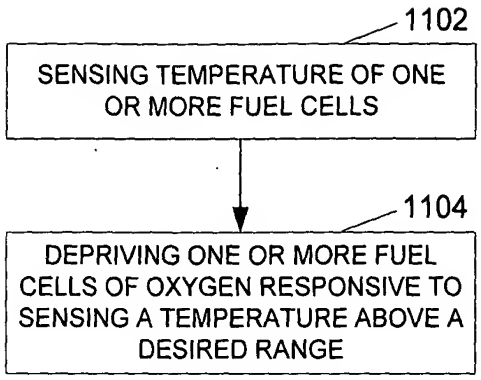

Fig. 11a

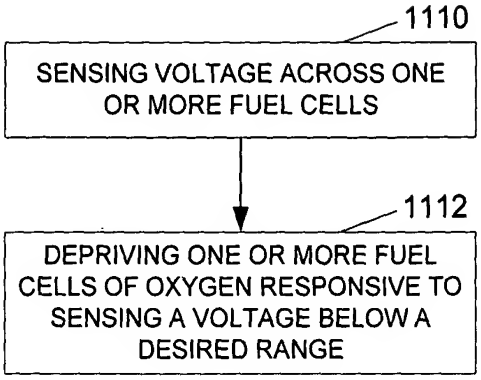

Fig. 11c

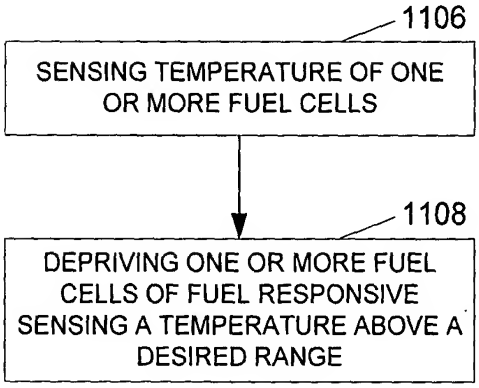

Fig. 11b

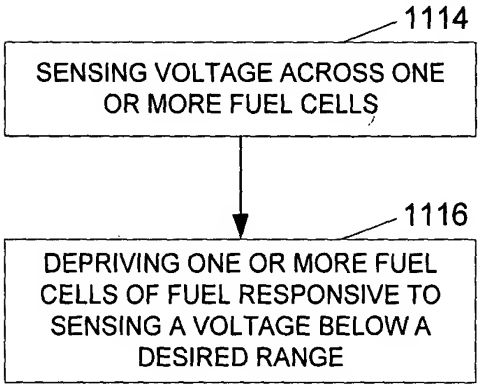

Fig. 11d